

Docket No.: 50-414

8 OCT 1986

Mr. H.B. Tucker, Vice President
Nuclear Production Department
Duke Power Company
422 South Church Street
Charlotte, North Carolina 28242

Dear Mr. Tucker:

SUBJECT: CATAWBA NUCLEAR STATION, UNIT 2 - REQUEST FOR ADDITIONAL INFORMATION
ON ALTERNATIVE PIPE BREAK CRITERIA FOR THE ACCUMULATOR AND PRESSURIZER
SURGE LINES

By letter dated June 18, 1984, you requested an exemption to the requirements of 10 CFR 50, Appendix A, General Design Criterion (GDC)-4 for the accumulator line pipe breaks. The staff has reviewed your request and finds that additional information, identified in Enclosure 1, is needed for completion of its review.

Furthermore, by letter dated May 29, 1984, you requested an exemption to GDC-4 for the pressurizer surge line pipe breaks. The May 29, 1984, letter supplemented your February 29, 1984 letter which provided the technical basis for the above exemption. The staff has also reviewed your submittals and finds that additional information, identified in Enclosure 2, is needed for completion of its review.

In addition, we request that the vendor, Westinghouse Electric Corporation, agree to release for each line the system parameters, margin numbers, specific system moments and forces, references to analytical methods, leak rates and reference crack sizes, which have been designated as proprietary. This information must be included in the NRC staff's safety evaluation to support its conclusions.

Your responses to the enclosures are requested within 60 days from the date of this letter. Please contact me at (301) 492-7367 if you have questions regarding the enclosures or are unable to meet the requested response date.

Sincerely,

8610150280 861008
PDR ADOCK 05000414
P PDR

Kahtan N. Jabbour, Project Manager
PWR Project Directorate #4
Division of PWR Licensing-A

Enclosures: As stated

cc w/enclosures:
See next page

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Mr. H. B. Tucker
Duke Power Company

Catawba Nuclear Station

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ATTACHMENT
REQUEST FOR ADDITIONAL INFORMATION

1. Material Characterization

- a) For the base and weld metal actually in the Catawba accumulator line provide the mechanical properties (e.g. ultimate and yield strengths) or other significant material properties that will characterize the material.
- b) Indicate the type weld and post weld heat treatment used to fabricate the welds in the accumulator line.
- c) Provide a materials evaluation to demonstrate that the material stress-strain curve in Figure 5-8, J_{IC} and the J-R curve used in the analyses are representative of the material in the accumulator line. This evaluation should follow the general guidelines in NUREG-1061, Vol. 3, and include a comparison, of the material properties for the accumulator line to the material properties for test data.
- d) Identify any welded fittings that may be in the accumulator injection system.

2. History of Cracking

Section 2.0 of WCAP 10537 should include references to NUREG-0691 and NUREG-0531 reports. Also, evaluate the susceptibility of the accumulator line to stress corrosion and fatigue cracking and water hammer relative to the experience base described in these NUREG's. ;

3. Loads

- a) List individual axial load and bending moment components used to determine the resultant axial forces and bending moments indicated on page 3-2 of WCAP 10487.
- b) Provide a qualitative discussion of why a circumferential flaw in a straight pipe section is more limiting than a longitudinal flaw in an elbow or other component.

4. Stability Analysis/Code Validation

- a) The stability analysis should meet the margins on load and flaw size in Sections 5.2 (h) and (i) and factor of 10 on leakage discussed in Section 5.7 of NUREG-1061, Vol. 3. The stability analysis should include the pipe and attachment weld materials.
- b) Describe the method of validating (bench marking) each computer code used in the leak rate and fracture mechanics calculations.

5. Leak Rate Analysis

- a) Describe the computational procedure used to calculate crack opening area.
- b) How were loads combined to determine the crack opening area in the leak rate calculation? Provide justification that the method of combining loads is conservative.

6. Fatigue Crack Growth Analysis

- a) The data cited in Reference 8-2 as the basis for the fatigue crack growth rate should be included in the report in graphical form that would illustrate and justify the fatigue crack growth

rate constants in equation 8-4 of WCAP 10487. These equations should represent the fatigue crack growth rate of the material characterized in item 1.

- b) The applicant will perform as realistic analysis as possible using service level A and B loads. The aspect ratio for the postulated crack in the fatigue evaluation should be 6. The aspect ratio should remain constant throughout the analysis. Unless otherwise justified the maximum allowable flaw depth is the smaller of:
- (1) 60% of the wall thickness, or
 - (2) the depth at which the plastic zone is equal to the remaining ligament.
- c) The length of the fatigue crack must be less than both:
- (1) the length of the instability thru-wall crack at $\sqrt{2} (N+SSE)$ and
 - (2) $1/2$ (instability thru-wall flaw at $N+SSE$)

The applicant is requested to confirm that the fatigue analysis includes the items listed in b) and c), above.

ATTACHMENT

REQUEST FOR ADDITIONAL INFORMATION

1. Material Characterization

- a) For the base and weld metal actually in the Catawba surge line provide the mechanical properties (e.g. ultimate and yield strengths) or other significant material properties that will characterize the material.
- b) Indicate the type weld and post weld heat treatment used to fabricate the welds in the surge line.
- c) Provide a materials evaluation to demonstrate that the material stress-strain curve in Figure 5-8, the J_{IC} and the J-R curve used in the analyses are representative of the material in the Catawba surge lines. This evaluation should follow the general guidelines in NUREG-1061, Vol. 3, and include a comparison of the material properties for the surge line to the material properties for test data.
- d) Identify any cast welded fittings that may be in the pipe system.

2. History of Cracking

Section 2.0 of WCAP 10487 should include references to the NUREG-0691 and NUREG 0531 reports. Also, evaluate the susceptibility of the surge line to stress corrosion and fatigue cracking and water hammer relative to the experience base described in these NUREG's.

3. Loads

- a) List individual axial load and bending moment components used to determine the resultant axial forces and bending moments indicated in Table 3-1 of WCAP 10537.
- b) Provide a qualitative discussion of why a circumferential flaw in a straight pipe section is more limiting than a longitudinal flaw in an elbow or other component.

4. Stability Analysis

- a) The stability analysis should meet the margins on load and flaw size in Sections 5.2 (h) and (i) and factor of 10 on leakage discussed in Section 5.7 of NUREG 1061, Vol. 3.
- b) The length of the longest pipe segment between supports may not be appropriate to define the effective pipe length required for computing the applied tearing modulus from equation 5-1 of WCAP 10537. Provide further justification to demonstrate that the calculated applied tearing modulus is reasonably conservative.
- c) Describe the method of validating (bench marking) each computer code used in the leak rate and fracture mechanics calculations.

5. Leak Rate Analysis

Describe the computational procedure used to calculate crack opening area.

6. Fatigue Crack Growth Analysis

- a) The data cited in Reference 8-2 as the basis for the fatigue crack growth rate should be included in the report in graphical form that would illustrate and justify the fatigue crack growth

rate constants in equation 8-4 of WCAP 10537. These equations should represent the fatigue crack growth rate of the material characterized in item 1.

- b) The applicant will perform as realistic analysis as possible using service level A and B loads. The aspect ratio for the postulated crack in the fatigue evaluation should be 6. The aspect ratio should remain constant throughout the analysis. Unless otherwise justified the maximum allowable flaw depth is the smaller of:
- (1) 60% of the wall thickness, or
 - (2) the depth at which the plastic zone is equal to the remaining ligament.
- c) The length of the fatigue crack must be less than both:
- (1) the length of the instability thru-wall crack at $\sqrt{2}$ (N+SSE) and
 - (2) 1/2 (instability thru-wall flaw at N+SSE)

The applicant is requested to confirm that the fatigue analysis includes the items listed in b) and c), above.